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AN EXTENDED ADAPTIVE STRUCTURATION THEORY FOR THE DETERMINANTS AND CONSEQUENCES OF VIRTUAL TEAM SUCCESS

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Completed Research Paper

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Abstract

Virtual teams represent an organizational form which can revolutionize the workplace and provide organizations with unprecedented levels of flexibility and responsiveness. Extant reviews on virtual team research lack in two important aspects: First they do not explain the inconsistencies in virtual team research, and second they fail to explain how virtual teams achieve success. This paper, based on an extensive literature review of available research on virtual teams, identifies key drivers of virtual team effectiveness. Integrating the identified drivers, it develops a conceptual, analytical framework with 9 propositions, to explain virtual teams' path to success. The new framework is termed as EAST (extended adaptive structuration theory). It goes beyond the generalized frameworks, such as AST (Adaptive Structuration Theory) and Input-Output frameworks to identify virtual team specific constructs such as Mission, Emergent Socio-Emotional States, and Individual Dimension. EAST identifies potential areas of future research for scholars, and provides advice to IS professionals regarding how to deploy virtual teams.

Keywords: Template, formats, instructions, length, conference publications

Introduction

Since last decade, the research on virtual teams is focused on number of challenges faced by the computer-mediated teams such as communication (Jarvenppa et al. 1999; Steinfeld et al. 2002), collaboration (Donker et al. 2008; Geyer et al. 2001; Hollingshed et al. 1993; Steinfeld et al. 2002), trust (Jarvenppa et al. 1999; MacDonough et al. 2001; Sarkar et al. 2002), technology (Hollingshed et al. 1993; Timothy Kayworth et al. 2000), design (DeMeyer 1991; Galegher et al. 1994; Suchan et al. 2001) and so forth. However, there is little consensus among researchers regarding virtual team effectiveness, which is made apparent by the existing literature reviews on virtual teams (Martins et al. 2004; Pinsonneault et al. 2005; Powell et al. 2004). Why are the results inconsistent? Are there any unstudied factors which can explain the inconsistencies in research? If so, how are they related to virtual teams, and how can they be merged with the issues at hand in contemporary virtual teams research? These are the questions that this research focuses on.

There have been four comprehensive reviews on extant virtual team research (Hertel et al. 2005; Martins et al. 2004; Pinsonneault et al. 2005; Powell et al. 2004). Powell et.al (2004) first reviewed the existing body of research and summarized the general overall research on virtual teams, giving researchers and practitioners a general understanding of virtual teams and broad trends by which individual studies could be compared. Martins et.al (2004) extended this study by including more studies and introducing moderating factors. Pinsonneault and Caya (2005) probed much deeper into a larger pool of studies and presented a more comprehensive view of virtual team research. Hertel et.al (2005) developed a life-cycle model of virtual teams, explaining how virtual teams move from launch phase to disbanding phase. These qualitative reviews identified the fact that several dysfunctional team processes are likely to emerge as virtual teams work towards a goal. However, present reviews lack in two important aspects: First, they do not provide any explanation for existence of such dysfunctional processes. Second, they do not highlight virtual team's path to effectiveness. Thus, we feel that there is a need for another review of virtual team research so as to clarify this paradox and to propose a holistic theory of virtual team's path to success.

This research starts from questioning why there are still inconsistencies present in a body of research which spans over more than two decades. First, an assumption was made, that since the results are inconsistent (i.e. some studies find support for some relationships, while some don't), there must be some moderating factors which haven't been considered by researchers yet. To determine such constructs, existing theories explaining the holistic working and dynamics of virtual teams were studied. We found that existing theories fail to capture the complete picture of virtual team dynamics. Hence, this research proposes *Extended Adaptive Structuration Theory (EAST)* to explain how virtual teams achieve success. The central tenet of EAST is structuration (DeSanctis et al. 1994a; Giddens 1984) which depicts a dynamic picture of the linkages between IT, people, tasks, organizations, and processes by which virtual teams collaborate successfully across the boundaries of space, time and organizations by establishing explicit relationships between key drivers of virtual teams.

Background Theories

Number of studies in team research has adopted the *Input-Process-Output (IPO) model* for their conceptual and empirical research. This trend can be attributed to the classic works of researchers such as McGrath (1984), Hackman (1987), and so on, who expressed the nature of team performance following the systems theory in which inputs lead to processes, which in turn lead to outcomes.

Structuration is posited as a social process that involves the reciprocal interaction of human actors and structural features of organizations (Orlikowski 1992). Desanctis and Poole (1994a) adopted the structuration theory to explain the role of advanced information technology (AIT) in organizational change and called this new theory *Adaptive Structuration Theory (AST)*. Consistent with the structuration theory, AST focuses on the social structures[1] provided by AITs (facilities for co-ordination and interpersonal exchange, provided by AIT; for example: Group decision support systems (GDSS) provide electronic paths for exchanging of ideas among meeting participants) and institutions as a basis for human activity.

[1] In the field of sociology, *social structures* are defined in terms of relationships between human beings. AIT consists of features which provide (facilitate) co-ordination and interpersonal relationships (relationships between human beings using the AIT). Hence, it is said that AIT consists of social structures.

Although, number of researchers have converged on the above three theories to explain virtual teams' path to success, this research argues that the above theories have some limitations, which render them insufficient to capture the full dynamics of virtual teams. The limitations can be explained as:

In the I-P-O framework, the causal effect moves in a linear direction from inputs to process to outputs (i.e. the processes can't influence the inputs). However, virtual teams are complex adaptive systems, which work over time on interdependent tasks to reach a final goal. The key word here is "adaptive" which implies that processes also influence the inputs over time, and thus the relationship isn't linear.

Although AST can explain the reciprocal relationship between inputs and processes, the spatial, temporal and organizational dispersion of virtual teams present some challenges which can't be explained by the AST. The challenges are enumerated as follows:

First, transfer of knowledge requires close interaction and buildup of shared understanding and trust among individuals (close interaction is not possible due to distributed nature of virtual teams). Thus, processes such as communication, co-ordination, and socio-emotional factors such as trust, shared understanding, cohesion and conflict become significant. AST doesn't support studying and measuring these factors.

Second, both the I-P-O and AST are not goal-oriented. Virtual teams start working with a specific goal. The goal or mission of a team provides a structure to its interaction. AST is incapable of explaining this aspect of team interaction. Therefore, we argue that previous theories are inadequate for explaining virtual teams' internal activities and their success. This research claims that a new theory is needed to explain the path of virtual teams to effectiveness.

Literature Review

Drawing upon an extensive literature review on virtual team, we identified key dimensions and their definitions that are divided them into three categories: Structural Characteristics, Social Interaction, and Outcomes. Key dimensions and their definitions are summarized in Table 1.

Table 1. Constructs in the EAST framework

Variables	Definitions
Organizational Dimension	The entities in organization which form the social context in virtual teams.
Organizational Culture (Schein 2004)	- Organizational Culture can be defined as a pattern of shared basic assumptions that a group learned as it solved its problems to external adaptation and internal integration that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way you perceive, think, feel in relation to those problems
Organizational Structure	- The hierarchical structure present in organization
Training	- The efforts taken by organization to familiarize virtual team members with the issues involved in virtual environments
Task Dimension	The tasks performed by a virtual team while moving towards its goal.
Generate (McGrath 1984)	- These tasks are collaborative and cooperative in the sense that the group is not required to decide on a single best response or to evaluate the quality of members' contribution
Choose (McGrath 1984)	- These tasks require co-ordination in a more typical sense. Value of contribution that each member makes to the group product depends on the contribution of other members
Negotiate (McGrath 1984)	- These tasks involve issues that are subject to party's values and attitudes versus facts and involve inherent conflict in viewpoints or interests.

Technology Dimension	The technology characteristics used by virtual team members.
Multiplicity of Cues (Daft et al. 1987)	- Multiplicity of cues refers to the number of ways in which information can be communicated, such as text (spoken or written words themselves), verbal cues (tone or voice), or non-verbal cues (physical gestures).
Social Presence (Short et al. 1976)	- The extent to which a technology enables a communicator to experience communication partners as being psychologically present.
Parallelism (Dennis et al. 1999)	- Parallelism is the number of simultaneous conversations that can exist effectively.
Immediacy of Feedback (Daft et al. 1987)	- Immediacy of Feedback is the extent to which a medium enables users to give rapid feedback on the communications they receive
Group Dimension	The culture and awareness present in virtual group members.
Cultural Diversity	- The diversity of national, regional, organizational culture present in a virtual team.
Awareness (Dourish et al. 1992a)	- The level of knowledge individuals have regarding other members' activities in a virtual team.
Individual Dimension	Personality of a team member and the knowledge possessed by a team member
Personality (Balthazard et al. 2004)	- Qualities possessed by a team member
Knowledge (Balthazard et al. 2004; Kayworth et al. 2000)	- Technical and functional expertise of a team member
Emergent Socio-Emotional States	The feelings of trust, cohesion, relationships developed by the teams.
Trust (Jarvenpaa et al. 1998)	- Trust can be defined as belief or expectation, that in the virtual team system, team members will behave as expected, irrespective of the ability to monitor of control the team members.
Shared Understanding (Rooji et al. 2007)	- Shared understanding can be defined as an organized understanding or mental representation of knowledge that is shared by team members.
Cohesion (Chidambaram 1996)	- Cohesion can be defined as feeling of closeness and bonding between team members.
Conflict (Boulding 1963)	- Conflict in virtual teams can be defined as awareness by some or all of the members of differences, discrepancies, incompatible wishes or irreconcilable desires.
Decision Processes	The processes that teams use to make decisions while moving towards a specific purpose
Communication	- The manner in which two spatially dispersed members of virtual teams connect with each other
Coordination (Montoya-Weiss et al. 2001)	- The manner in which the team members manage the temporal patterns of the team's behavior
Conflict Management Style (Paul et al. 2004)	- A mechanism which is the preferred behavior that people use in order to resolve a conflict
Outcomes	The dependent variables which define the effectiveness of virtual teams
Performance	- In EAST, performance is defined by the values of dependent variables such as solution time and solution quality.

Satisfaction	- Satisfaction is defined by two dependent subjective variables, solution satisfaction, and satisfaction with the experience of working in a virtual team

Organizational Dimension

Virtual teams are a new form of organization, in which organizational structure can be defined in terms of communication linkages among organizational units (Zack et al. 1995). These communication linkages are enabled by technology. However, since communication is a social process, to determine the effectiveness of virtual teams, it is imperative that we understand how existing social processes (in organizations) viz. organizational culture and organizational structure influence patterns of this new form of organizational communication (Zack et al. 1995).

Such technology-enabled communication linkages are something new, and the social communication among members of virtual teams is clouded by ambiguity and uncertainty. Thus, educating virtual teams regarding the difference in group work or collaboration in virtual environment, use of new technologies and so on will go a long way to achieve effective performance from virtual teams. Such training will be provided by organizational management or organizational structures controlling the virtual teams. Thus, we define organizational dimension as consisting of three components: *organizational culture, organizational structure*, *and training.*

Task

Task has been an important dimension in the study of most work groups. The group processes and performance cannot be explained without taking into account the nature of tasks being performed (Strauss 1999). This research adopts the typology of tasks proposed by (McGrath 1984). McGrath proposed that most group tasks can be classified into categories that reflect the following four basic processes: *generate, choose, negotiate,* and *execute.* The reason of choosing McGrath's task Circumplex over other typologies of tasks is that it has been used in a number of computer mediated communication studies (Connolly et al. 1990; Daly 1993; DeSanctis et al. 1987; Pissarra et al. 2005; Zigurs et al. 1988). None of these studies have included "execute" task of the Task Circumplex. Following the studies, we consider only three task types: *Generate, Choose,* and *Negotiate*.

Technology Dimension[2]

Technology has been discussed in virtual team research in terms of its features such as richness, social presence, and synchronicity and so on. Many theories (information processing theory, critical social theory and so on) have been applied to study the effect of richness of technology on virtual team interaction. Among them, media richness theory, by far, has been the most used (Daft et al. 1986; Rasters et al. 2002). The core of media richness theory states that performance improves when managers use richer media for equivocal tasks and leaner media for non-equivocal tasks (Daft et al. 1986; Daft et al. 1987).

Claiming that most of the present research haven't found support for media richness theory, Dennis and Valacich (1999) proposed that task performance is not contingent upon matching the media characteristic to the task. Instead, performance comes from the matching of media capabilities to communication processes required to accomplish a task, given certain levels of group and task familiarity and situational constraints. This research concurs with Dennis and Kinney (1998) and defines media based on their fundamental characteristics such as multiplicity of cues, immediacy of feedback (Daft et al. 1986), social presence and parallelism (Dennis et al. 1999).

Team Dimension

Team Dimension such as cultural diversity and awareness have been found out as major influential structural characteristic for virtual teams (Hertel et al. 2005; Massey et al. 2001). Researchers (Kayworth et al. 2000; Maznevski et al. 2000) suggest that cultural diversity leads to different ways of using technology and eventually to co-ordination difficulties. They also create barriers to effective communication (Kayworth et al. 2000; Sarkar et al. 2002). All interdependent work entails uncertainty about others' behavior (Weisband 2002). Factors such as information sharing, knowledge of the group and individual activity contribute towards what is termed as awareness in groups. Awareness, i.e. an understanding of the activities of others, provides a context for your own activity (Dourish et al. 1992a).

[2] This research only focuses on communication technologies.

Individual Dimension

Individual Dimension includes two factors: Personality and Knowledge. Researchers have shown the positive influence of personality variables (extraversion) on team performance and cohesion (O'Neill et al. 2008). Extraversion was found to be the "key" personality trait at individual level (Barry et al. 1997), and the limited research that studies personality in the virtual team domain also have studied only extraversion (Balthazard et al. 2004; Strauss 1996). Thus, in this study, we also consider only extraversion as personality variable.

We define knowledge as the technical expertise (Kayworth et al. 2000), expertise on the functional area (Balthazard et al. 2004) possessed by a team member. Technical expertise has been shown to develop high trust among team members (Jarvenppa et al. 1999).

Emergent Socio-Emotional States

These consist of factors such as shared understanding, conflict, cohesion, and trust. Reaching a degree of shared understanding about a team's task, structure and procedures tends to be more complex in virtual teams than in co-located teams (Maynard et al. 2004). Virtual teams have a hard time developing shared understanding due to the cultural diversity, preferred management style, and others (Rooji et al. 2007). Hinds and Bailey (2003) in their study about understanding conflict in virtual teams suggest that anticipated effect of technology mediation on group conflict appears to be negative i.e. use of technology can lead to conflict in distributed teams. Mortensen and Hinds (2001) suggest that the levels of affective and task conflict will be higher in computer-mediated groups, since information exchange is less complete in a technology-mediated communication than in face-to-face communication. Trust has been a prolific area of research with respect to virtual teams, probably due to the physical and socio-emotional distance that virtual team setting entails among team members. Researchers have studied antecedents of trust development, role of trust in virtual team processes and influence of trust on virtual team effectiveness. Trust development in virtual teams also presents significant challenges because it is difficult to access team-mates' trustworthiness without ever having meeting them (MacDonough et al. 2001).

Decision Processes

These involve processes like communication and collaboration which lead to decision making through action. Research on virtual team has focused on the need to create a team of excellent communicators, selection of right technology for most effective communication etc (Powell et al. 2004). Communication between virtual teams is impaired due to technology which is a lean media as compared to rich face-to-face interactions (Kiesler et al. 1992). In addition to this, researchers have found that lack of mutual awareness hamper communication (Crampton 2001). Early results suggest that, the frequency and predictability of communication and the extent to which a feedback is provided on a regular basis, improves team communication leading to higher trust and improved performance (Jarvenppa et al. 1999).

Co-ordination has been linked to virtual team performance. Cultural diversity, time difference and mental models have been found to have a negative impact on virtual team co-ordination (Galegher et al. 1994; Powell et al. 2004). Past research (e.g., Baron 1989) has shown that *conflict management* behavior is an important determinant of group processes and performance. Along with types of conflicts and their influence on performance, researchers have also studied the methods of conflict management (Montoya-Weiss et al. 2001; Paul et al. 2004). Virtual teams try to manage their internal conflict using competitive and collaborative conflict management styles (Montoya-Weiss et al. 2001). Among these, the collaborative conflict management style was found to be positively related to satisfaction, perceived decision quality and participation (Paul et al. 2004).

Performance

Much of the early research in the field of virtual teams compared the performance of virtual teams with face to face teams. Although some studies did find out that virtual teams took longer to reach a solution (Galegher et al. 1994), most researchers did not observe differences in the solution quality (Archer 1990).

Satisfaction

Again, early researchers studied whether there is any difference between satisfaction with group processes in face-to-face teams and virtual teams (Dennis et al. 1998; Straus et al. 1994). In general, lower levels of satisfaction are reported in virtual teams than in face-to-face teams (Strauss 1996; Warkentin et al. 1997). It has been suggested that virtual teams using or relying on multiple communication media express more satisfaction with the process than virtual teams using only one communication medium (Pinsonneault et al. 2005).

Extended Adaptive Structuration Theory (EAST) and Propositions

Consistent with the structuration theory, and later with AST, EAST focuses on the reciprocal action between the structures of "virtual team environment" and the "knowledge producing interaction[3]" (*social interaction* in the framework) among virtual teams. EAST proposes five types of structures (task-technology fit, mission, organizational dimension, team dimension, and individual dimension) mapped into the three generic structures provided by the structuration theory: *Signification, Domination* and *Legitimization.*

Virtual teams start by undertaking a specific "mission". Virtual team members start by dividing the mission into several tasks such as idea generation, planning, decision making, and negotiation and so on, each of which they solve using different technology characteristics. Every time they use a technology characteristic to carry out a particular task, different type of information is produced. This information will lead to emergence of socio-emotional states, as well as initiation of decision processes.

For example, suppose a group uses video-conferencing for generating ideas. Aggressive members might dominate the session by chipping in with the most ideas on one hand, while cutting off other members in between with critical evaluative comments (difference of opinions enhances the chances of conflict among virtual teams (Hinds et al. 2003)). However, a tool such as an electronic brainstorming system is characterized by low immediacy of feedback. Such a tool might enhance the output of idea generation task in two ways: First, it might reduce the social anxiety in the group by allowing members to type, rather than verbalizing their ideas; and second, it can reduce communication based co-ordination losses (e.g. turn taking), by allowing members to simultaneously enter their ideas (Graetz et al. 1997). Using different technology characteristics to carry different tasks leads to transfer of different knowledge among virtual team members (which is eventually used to achieve the mission). Thus, the task-technology fit explains how and what information can be transferred into social interaction. In this manner, the task-technology fit brings meaning (*"signification"*) to virtual team interaction.

Consider that the mission of virtual teams is highly complex such as developing an integrated chip for a computer motherboard. Developing an integrated chip may involve two parts: designing and developing. Design of the IC might require members to undertake many idea-generation sessions (thus, mission will determine what kind of tasks the team indulges in). Another scenario could be that the team members divide the designing and developing parts amongst themselves (i.e. form subgroups). Thus, the interdependency among team members will increase and hence the demands for co-ordination and trust and so on. In this manner, the mission of virtual teams provides control (*"domination"*) to the team interaction.

The organization (which deploys virtual teams), the team and the individual members in virtual team, all constitute sets of established norms and values, with regard to using technologies with tasks. For example, an organization may be using a certain groupware to deploy virtual teams since many years. Based on the history of previously deployed virtual teams, organizations might train the new virtual team members as to how to use the organizational groupware, which feature of the groupware should be used for which tasks and so on. A person who is extrovert might be willing to use synchronous communication for group tasks, whereas a less extrovert member might prefer asynchronous technology. Thus, organization, team and, individual provide the general intent of using the social structures provided by the task-technology fit and constitute "*legitimization*" for EAST.

Thus, in summary, this research contends that mission of virtual team provides the "*domination*" structures. These structures will do two things: first, they will govern how and what kind of information is to be gathered; and second, they will determine the nature of social interaction required to convert this information into knowledge, which will achieve the mission. The task-technology fit will provide "*signification*", or social structures which can lead to generation and transfer of information. How the social structures provided by the task-technology-fit are used or "*appropriated*" (to gather information) is determined by the "*legitimization*" structures, i.e. the organization, team and individuals (i.e. members of team). Such an appropriation will lead to a certain form of social interaction. As the team continues to work towards mission by dividing work into tasks, the social interaction provides a common interest that gives the team an identity (awareness) and provides a foundation for teams to create rules (organizational culture) for communication processes. This way the social interaction influences the Structural

[3] Virtual team members interact amongst themselves to transform their collective information into knowledge, which ultimately leads to the specific goal undertaken by the team.

Characteristics. To the degree that virtual teams are able to produce the social interaction demanded by the mission, certain knowledge will be produced which will determine the effectiveness of virtual teams.

The conceptual EAST model with propositions is given in Figure 1. The propositions are put forth in the order that virtual teams move towards effectiveness of performance.

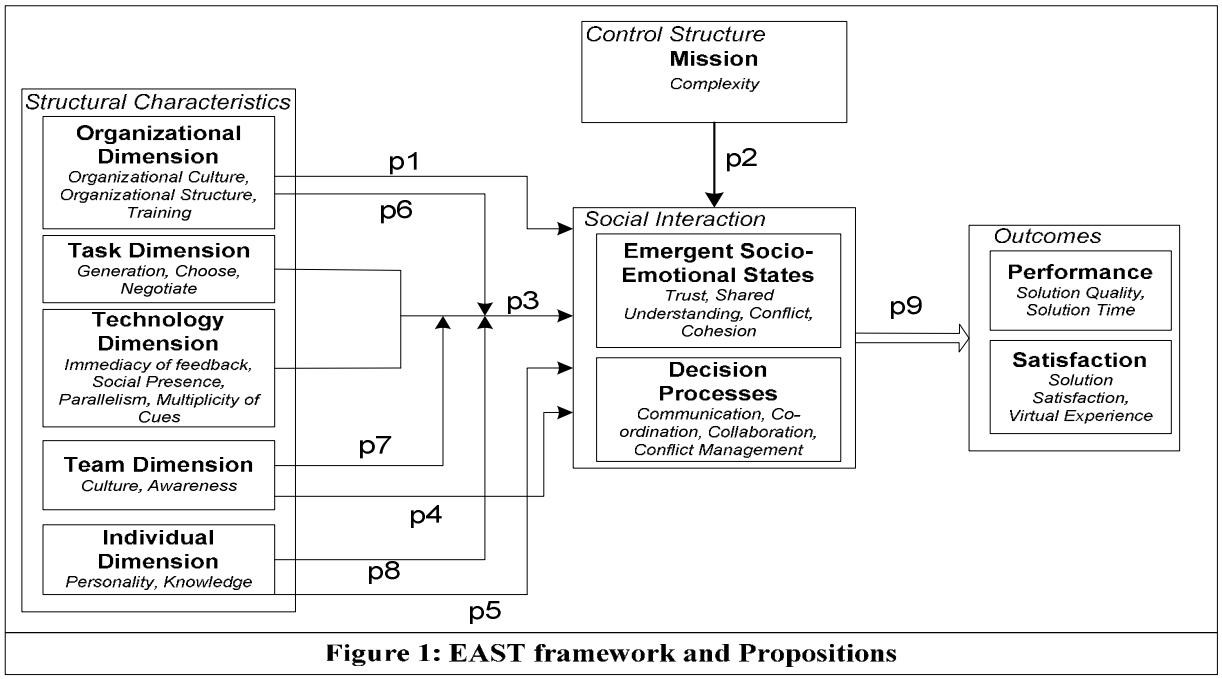

Figure 1: EAST framework and Propositions

Organizational Dimension

Organizational Culture is to be taught to new members as the correct way you perceive, think, feel in relation to those problems (Schein 2004). It may include set of organizational norms such as management styles, appraisals, communication styles used by employees, rewards and so on (Dafoulas et al. 2001). It can consist of values which focus on collaboration, respecting and working with people with different cultures, keeping criticism constructive and so on (Duarte et al. 1999; Schein 2004).

These shared patterns of norms and practices are related to emergent socio-emotional states such as trust, cohesion, shared understanding and so on (Frost et al. 1985). For example, the human resource practices of an organization studied by Maznevski and Chudoba (2000) rewarded teamwork and flexibility to foster cohesion among virtual team members. DeSanctis and Poole (1994b) define organizational culture to be the function of how a team behaves. A strong organizational culture exemplifies strong institution-based trust relationships (Nandhkumar 1999). It can be easily concluded that a strong organizational culture (i.e. the strong prevalent organizational influence on employees) will contribute to enhancing the possibility of reaching a shared understanding, developing trust and cohesion when organizational members communicate.

In face-to-face teams, physical proximity and availability of a number of verbal and non verbal cues lead to development of trust, cohesion among team members. This leads the members to converge on a decision faster than in computer-mediated distributed teams (eventually leading to lesser solution time). Since, in virtual teams, organizational culture positively influences the emergent socio-emotional states (trust, cohesion etc.) it can be argued that in absence of the advanced verbal and non-verbal cues presented by face-to-face interactions, organizational culture will help to lead to a faster solution.

Organizational Structure can be defined as the degree of hierarchy present in organization or the way in which processes are structured. An organization's product group can be structured to ensure quick responses to the customer, with a very flat hierarchy to facilitate strong relationships, quick communication and fast decisions. On the other hand, an organization's structure may be very hierarchical, restrictive and control oriented. Communication in such an organization may be restricted and may lead to more time in reaching solution. On the other hand, if the

structure of organization is flat, communication and coordination will be easy and the satisfaction of virtual team members with the virtual team experience will be more.

Training: Jarvenppa and Leidner (1998) found out those teams which were capable of managing the expectations of working virtually manifested high trust throughout the project. Beranek (2000) found out that teams which were trained on development of trust and relational links developed higher levels of relational links and trust than teams which did not receive training. Summarizing the above discussion, it can be said that, the organizational dimension influences the social interaction among virtual team members and eventually the effectiveness of virtual teams. Hence, it is proposed that

P1: *Organizational Dimension should influence the quality of social interaction and the effectiveness of virtual teams*

> **P1a**: Stronger the organizational culture, stronger the emergent socio-emotional states and decision processes, and lesser the time required to develop a solution.
>
> **P1b**: Flatter the structure of an organization, smoother the communication and coordination among virtual team members, and greater the satisfaction of virtual team experience.
>
> **P1c**: Training virtual teams on virtual environment issues will positively influence emergent socio-emotional processes and decision processes and hence the performance.

Mission

Extant research on virtual teams adopted the view of the mission of virtual teams as a single entity (Murthy et al. 2000). In real world, organizations deploy virtual teams with a goal which can rarely be considered as single entity, mainly because group members divide the goal into several sub-tasks (idea generation, planning, decision making and so on) and solve them to achieve the goal. The performance of virtual teams is contingent upon how these sub-tasks are carried out to achieve the goal. For example, a dispersed software development effort is divisible into small modules to be developed independently, with modules integrated into common product (Malhotra et al. 2001).

We define "mission" as an aggregate of sequential sub-tasks carried out by virtual team members to achieve a specific goal or common purpose. To characterize mission, definition of task complexity is adopted from Campbell's (1988) research work. Campbell defines complexity of task in four dimensions: *presence of multiple potential paths to arrive at a desired end-state, presence of multiple potential outcomes, presence of conflicting interdependence among paths to multiple outcomes, and the presence of uncertain and probabilistic links among paths and outcomes.*

Based on the complexity of mission, virtual teams must divide mission into tasks such as idea generation, planning etc. and use structural characteristics to define shared patterns of work, gain project commitment, build upon trust and relationships, and determine effectiveness measures and so on. This way mission brings "control" structure (*"domination"* in AST and structuration theory) to group interaction.

Multiple Paths: Multiplicity of paths implies an increase in the number of possible ways to arrive at a desired outcome. Complexity is increased if among these multiple paths, only one path reaches the desired outcome; whereas, complexity reduces if all paths are likely to result in the desired outcome. A virtual team is culturally and functionally diverse. Depending on the level of diversity, they may have different opinions regarding the ways to achieve the mission (more the diversity more will be the number of different suggestions). Difference in opinions might lead to conflict in virtual teams. Thus, it is reasonable to state that multiplicity of paths to an outcome enhances the chance of conflict in virtual teams. Following this, a greater effort at conflict management might be required. On the other hand, if virtual team members discuss their differences regarding different ways to reach the outcome, a shared understanding might develop among the team members (Huysman et al. 2003). Such a shared understanding of each others' perspective might even bring them closer, thus making them a cohesive unit.

Multiple Paths, Multiple Outcomes: As number desired outcomes of mission increases, complexity also increases. Each outcome of the mission should be thought about by the virtual team members as a mission dimension, which requires attention (Campbell 1988). It can be assumed, that each sub-group will divide their part of mission into tasks, and thus there will be number of parallel tasks going on in the virtual team at a time. Division of mission, and subsequent role assignment might imbibe confusion among team members. Scheduling and rescheduling might have to be done in each of the sub-groups thus increasing the total required co-ordination among virtual team members.

Conflicting Interdependence and Uncertain Linkages among Paths: Tasks characterized of conflicting interdependence have negative relationships among desired outcomes. If achieving one desired outcome conflicts with achieving another desired outcome, complexity will increase (Campbell 1988). The teams may develop patterns of shared understanding, trust etc initially when they start working. For example, the team can decide that all the information will be entered into a shared space, so as to share among all members all the time (Malhotra et al. 2001). However, if there are uncertain linkages between the paths to desired outcomes, it will be difficult for virtual team members to discard any of the information from the shared workspace, since potential paths cannot be eliminated quickly. This might lead to addition of a lot of information to the shared workspace, causing the problem of information overload. Team might change their ways of communication to overcome such a problem. For example, the team might decide to meet more often virtually to negotiate which information should be removed from the shared space etc. Hence, it is proposed that:

P2: *Mission of virtual teams will provide control structure which can be defined in terms of its complexity. To the extent that mission varies in complexity, different forms of social interaction are encouraged by the mission.*

Fit Between Task and Technology

It has been shown that characteristics of tasks of a group account for more than half of the group interactions (Zigurs et al. 1998). Since in virtual teams, tasks are carried out over technological links, the relationship between task type and technology characteristic (i.e. task-technology fit) should be deemed important. It logically follows that the function of task characteristic as a strong determinant of group interaction (in co-located teams) should be replaced by the fit between task and technology in virtual teams. Task-technology fit theories argue that use of technology may result in different outcomes depending upon its configuration and the task for which it is used (Goodhue et al. 1995). Researchers have concentrated on the relationship among three constructs: *task, technology* and *performance/effectiveness* (Dennis et al. 1998); (Graetz et al. 1997). Outcomes of a group are a function of not only the task, but also the group processes (Marks et al. 2001). Still, surprisingly, there are only a handful of studies which have studied the influence of the fit between task and technology on group interaction factors such as communication (Ngwengama et al. 1997; Rasters et al. 2002), cohesion (Kelly Burke et al. 1999) whereas, the influence of the fit on other significant factors such as trust, conflict, co-ordination has remained unexplored.

Media synchronicity theory (1999) suggests that media has five capabilities, which are important in understanding the effectiveness and efficiency of communication and subsequently information processing; immediacy of feedback, multiplicity of cues, parallelism, rehearsability and reprocessability. This research, for the purpose of simplicity, includes rehearsability and reprocessability as parts of parallelism. Although this research recognizes the distinction between these three media capabilities, it also acknowledges the fact that rehearsability and reprocessibility are associated with parallelism such that they all allow the sender of message a discretion of time, i.e. a sender is not dependent the response of the receiver to send his message.

Generate tasks are those in which group members focus on generation of ideas, plans and so on. These tasks encourage unconstrained collaboration. The previous statement implies two things: 1. Group is not required to decide on a single best response, nor do they have to evaluate the quality (of responses), and 2. Group productivity is a cumulative function of the single ideas generated by group members. Members of a group can share divergent information and are not required to focus on the same information simultaneously (Dennis and Valacich, 1999). As per the definition of generate tasks, group is not required to indulge in evaluation of ideas generated. This research considers the "generate task" as a part of a larger (or final) group task, i.e. "mission". Thus, while generating ideas, the goal of the virtual team members should be meeting some qualitative criterion, with respect to the mission of the virtual team. Non evaluation of generated ideas might result in large number of moderate ideas, which do not meet the quality criterion demanded by the mission of the virtual team. Thus, we argue that virtual team members will evaluate ideas generated by other group members.

Researchers have studied team by providing technology which allows them to type instead of verbalizing them. It has been found that such a technology leads to reduction of social anxiety among team members. Thus, reduced social presence and multiplicity of cues leads to reduction of social anxiety among team members. Social anxiety leads to affective conflict in virtual teams (Hinds et al. 2003). It follows that when virtual team members use technology with reduced social presence, less cues for the generate task, conflict among team members will be less or contrarily, high social presence (ex. Audio/video conferencing) and high multiplicity of cues for generate tasks should lead to increased conflict in virtual teams.

Choose tasks require more co-ordination as compared to Generate tasks. Problem solving can be stated as an example of intellective tasks. Shared Understanding can be easily achieved in these tasks. Even if one individual comes up with an answer, it is considered to be a group answer (McGrath 1984). This suggests that members are not interdependent and level of co-ordination required is low. Parallel communication appears conducive to production of previously un-discussed information (Dennis, 1996). Using a parallel technology for intellective tasks will positively influence shared understanding among virtual team members. In intellective tasks, group members have to carefully process the pieces of information that are presented by other group members. This can be achieved by the means of just factual information without resorting to social presence. However, immediate feedback on the acceptance or non acceptance of a solution provided by members can lead to increase in trust among virtual group members.

In judgment tasks the group is seeking an optimum or preferred answer and thus, attaining consensus requires communication not just of facts, but also values, beliefs and attitudes about the merits of alternative solutions. High multiplicity of cues will allow for the high co-ordination among team members. If group members are able to emphasize important points, display uncertainty, the amount of knowledge each members have will be known. The level of knowledge and integrity possessed by individual members are antecedents of trust. Since judgment tasks do not have any correct answers, attaining group consensus is very important. Immediacy of feedback enables mid-course corrections in message transmission, so that misleading elements in the message as sent can be quickly corrected. A media with high immediacy of feedback will allow members to communicate more leading to cohesion and share more views regarding the solution.

Negotiation Tasks: These tasks are the most interdependent of the three and reaching consensus among group members is highly dependent on co-ordination of group members. Using parallel media with negotiation tasks would impede communication and co-ordination among team members. A technology with high immediacy of feedback will increase co-ordination and communication. Since, group members' values are an issue with these tasks, the presence of as many cues as possible will be necessary to reach a good decision. These tasks are said to generate highest number of conflicting viewpoints among group members. Conflicts can't be just resolved based on factual information. Thus, technology with social presence will help develop trust and hence cohesiveness among group members. An example of how different media characteristics used with different tasks will influence social interaction in virtual teams is given in Table 2.

Table 2. Task-Technology Fit[4]

Task Type / Technology Features	Generate Tasks	Choose Tasks		Negotiate Tasks
		Intellective Tasks	*Judgment Tasks*	
Multiplicity of Cues	Communication (+)	-	Trust (+)	Co-ordination (+), Communication (+)
Social Presence	Conflict (+), Coordination (-)	-	Shared Understanding (+)	Trust (+), Cohesiveness (+)
Parallelism	Co-ordination (+), Trust (+)	Shared Understanding (+)	Communication (-), Co-ordination (-)	Conflict (+), Trust (-)
Immediacy of Feedback	Co-ordination (-)	Trust (+)	Shared Understanding (+), Communication (+), Cohesion (+)	Co-ordination (+), Communication (+)

Based on the above discussion it is proposed:

[4] This research acknowledges the fact that the correlations presented in this table are by no means exhaustive or the only ones probable. However, since there hasn't been any previous effort to find out the outcomes of task-technology fit among virtual teams, we want to demonstrate what kind of relations are possible for researchers for future study. This is deemed to be the pioneer step towards documenting influence of task-technology fit on social interaction processes and states in a virtual team setting.

P3: *The nature of social interaction among virtual team members will depend on the task type and the set of technology characteristics used for the task.*

P3a: Emergent Socio-Emotional States will vary contingent on the fit between the task type and the technology characteristics used for the task

P3b: Decision Processes of virtual team will vary contingent on the fit between the task type and the technology characteristics used for the task

Team Dimension

Since virtual teams are a group of functionally, culturally and geographically dispersed individuals, it will be characterized by different human behavior as compared to homogenous group of people, which will have a certain influence on the social interaction.

Cultural Diversity: Distance increases heterogeneity among a group of people which is mostly related to different cultures (Mortensen et al. 2001). As compared to technological aspects, cultural diversity has received less attention of scholars (Anawati et al. 2006). Cultural Diversity is reduced as members of virtual team work towards developing mutually acceptable practices of interaction based on mutual work experiences. Based on the cultural diversity literature on virtual teams, this research observes and defines two types of cultural diversities:

Regional Cultural Diversity: National cultural diversity arises due to team-members belonging to different countries. National culture can be defined as a "collective mental programming" of the people of any particular nationality (Hofstede et al. 1991). Armstrong and Cole (2002) observed that there are even site-specific cultures observable in distant teams. This paper adopts the definition of national cultural diversity and defines regional cultural diversity as: Regional cultural diversity is that which arises due to the "collective programming of the mind" which distinguishes the members of one region from another.

Regional cultural diversity can influence virtual team communication in a negative manner (Kayworth et al. 2000). As members of virtual teams communicate, they tend to interpret the shared information as per their regional culture, which can lead to a broad range of misinterpretations (Solomon 1995). Thus, it can be concluded that, the misinterpretation of communication should be contingent on the distance between the two regions. Greater the distance, more will be the regional cultural diversity, more should be the misinterpretations of communication.

Functional Cultural Diversity: Functional cultural diversity can be explained as virtual team members having different professional background, experience and expertise and corresponding priorities, assumptions and understanding (Pelled et al. 1999). Functional Cultural diversity will go on increasing as the difference in functional area of expertise will increase. For ex: an engineering background individual will have less functional cultural diversity with an individual with science background, whereas more functional cultural diversity with an individual of business background. Since there is dissimilarity in expertise in virtual team members, they may have trouble establishing a shared functional language. Functional cultural diversity can lead to conflict in virtual teams. Because of different functional contexts, it becomes more difficult to make and interpret references to objects of interest (Schrober 1998). In a recent study, Kankanhalli et.al (2007) found that, teams having more functional cultural diversity experienced more conflict than teams having less functional cultural diversity.

Awareness: Previous literature has demonstrated the necessity of awareness for successful and effective collaboration, and co-ordination. Weisband (2002) found that teams that shared information about where they were and what they were doing performed better that teams who did not. Awareness of other group members' activities lead to similar behavior of group members (Weisband (2002); Palen (1999)). Such a similar work ethic can lead to increased cohesiveness as well as shared understanding among virtual teams.

Researchers agree that awareness can be established among members of virtual teams by two main mechanisms: *explicit generation* and *passive collection* (Dourish et al. 1992a; Gutwin et al. 2004). In explicit generation mechanism, it depends upon individual members of virtual teams to send information to other group members (Dourish et al. 1992a). In passive collection, virtual team members might collect information regarding other team members by just observing other's activities (Gutwin et al. 2004). Or, some tools provide video links to worksite of geographically dispersed teams. Thus, virtual team members can observe the activities of members of geographically dispersed teams (Dourish et al. 1992b).

However, although explicit awareness mechanisms do generate information and awareness, there are some limitations to the type of awareness generated, or situations to generation of awareness. First of all, the information

provider stands no benefit by generating the information, since it is going to cost him time and effort to do so. On the other hand, producing information requested might negatively influence productivity. It can be gathered from the above discussion that virtual teams may face significant communication and coordination breakdowns due to explicit awareness generation mechanisms.

Whereas, passive awareness collection mechanisms provide shared artifacts, whereby team members come to know of details of changes made to information by other members. For example, a collaborative tool FASTDash (Biehl et al. 2007) focuses on providing a real-time awareness of fellow team members' activities within shared code base (such as, who has which file open, or what files are currently being edited and so on). Such temporal patterns helped the remote sites co-ordinate activities with each other.

P4*: The nature of social interaction will vary depending on variations in group dimension*

P4a1: Greater the regional cultural diversity among virtual team members, poorer should be the communication in virtual teams.

P4a2: Greater the functional cultural diversity among virtual team members, greater should be the conflict in virtual teams.

P4b: Explicit awareness generation mechanism should negatively influence the decision processes. Passive collection mechanism should positively influence the decision processes as well as emergent socio-emotional states.

Individual Dimension

A team demonstrates different interaction styles (social interaction in this study) while collaborating towards their goals. It has been showed that team's interaction style influences performance (Watson et al. 1988). The interaction styles are an aggregation of behaviors exhibited by individual team members which are rooted in their individual personalities and knowledge (Balthazard et al. 2004).

Personality: Personality has been consistently shown to have a positive relationship with successful task performance. Extraversion refers to the degree to which individuals are gregarious, friendly, compliant, co-operative, nurturing, caring and sympathetic in contrast to introversion which is characterized by those who are shy, unassertive and withdrawn (Balthazard et al. 2004). Extroverts are usually active participants in group interactions and often have high intra-group popularity (Barrick et al. 1991; Barry et al. 1997). Thus, extroverts being popular within groups can influence other group members to exchange social information through communication technologies. Exchanging social communication has been suggested as an avenue to build relationships among virtual teams (Powell et al. 2004). Virtual teams that send more social communication achieve higher trust (Jarvenppa et al. 1999) and better social and emotional relationships (Robey et al. 2000)**.**

Knowledge: Many virtual teams are by design, cross functional and include a number of experts in different domains. Having diverse technological skills may lead to conflict as members can't agree upon the type of technology to be used (Sarkar et al. 2002).. More the knowledge possessed by an individual in a group, more will be the contributions he will be able to make to group knowledge. Literature (Wasco et al. 2000) has evidence that individuals with superior expertise contributed more knowledge to virtual groups. In virtual groups, contributing information may substitute for more traditional methods for establishing credibility of an individual's ability, usually found in co-located groups (Ahuja et al. 2003). Ability of an team members is an antecedent of trust in virtual teams (Jarvenpaa et al. 1998). Equal level of knowledge possessed by every team member leads to increased cohesiveness, trust and higher perceived decision quality in virtual teams (Tan et al. 2000; Warkentin et al. 1999). Thus, through straightforward information exchanges, knowledgeable virtual teams may be able to produce better quality solutions (Balthazard et al. 2004). Based on the above discussion, it is proposed that:

P5: *Social Interaction will vary as per the variations in the Individual Dimension*

P5a: Personality of individual virtual team members will influence socio-emotional processes as well as decision processes.

P5b: The degree of knowledge (of virtual team members) will be positively related to trust, communication, and cohesion in virtual teams and will lead to better solution quality. The diversity of knowledge (among virtual team members) possessed by virtual team members will be negatively related to conflict and cohesion in virtual teams.

Appropriation of Task-Technology Fit

Only the fit between task and technology does not facilitate effective communication as proposed by media richness and media synchronicity theories. This can be supported by the fact, that virtual teams have been able to communicate effectively even using simple technologies such as email (Ngwengama et al. 1997). The effectiveness of these technology theories for successful communication depends on the context in which the technology is used. The context in which the technology is used adds additional meaning to the communication (Canessa et al. 2003). Thus, the effectiveness of the task-technology fit is determined by selection of the fit by organizational, team and individual dimensions and is termed as "appropriation" in this study.

Organizational Dimension: A plethora of technologies are available today for teams to collaborate virtually. The decision to invest and incorporate technology will depend on the impressions and reviews of new technologies which management of an organization obtains from IT vendors, consultants, and other organizations and so on (Naik et al. 2009). In addition, history of implementing virtual teams and using technologies can be determined by organizational culture. For example, IBM has, since long researched and encouraged employees the notion of collaborating in virtual worlds such as Second Life. Thus, members of an IBM virtual team will be more than likely to use virtual worlds to carry out negotiation tasks such as meetings, discussions, debates and so on. Whereas, an organization which encourages the use of IM (Instant Messaging) and e-mail by employees might make members of virtual team to use IM for social presence (Turner et al. 2006). Hence, it is proposed:

P6: *The fit between task type and technology characteristics will be determined by the organizational dimension.*

Individual Dimension: Different personality of leaders, diversified technological skill will all lead to different patterns of technology use. For example, transformational leadership can be defined by following features: *charisma* or *idealized influence, individualized consideration, intellectual stimulation* and *inspirational motivation.* Inspirational motivation implies that the leader communicates high expectations to followers and often emotionally appeals to the followers (Bass 1985; Lowe et al. 1996). This inspirational motivation is often expressed with emotions and personal interaction among team members and involves exchange of cues which lead to warmth, trust and emotional state. Thus, to provide inspirational motivation transformational leadership style may choose technology high in multiplicity of cues to promote relational trust building.

P7: *The fit between task type and technology characteristics will be determined by the individual dimension.*

Team Dimension: Features of technology can be altered to affect different types of awareness in users (Liccardi et al. 2007). Thus, the need for awareness for a task will dictate the use of technology by a team. Also, it has been found that culture leads to different use of IT. A culture determines to some extent a person's communication preferences and behaviors (Massey et al. 2001). A culture can be individualistic (preference to act as an individual) or collectivist (preference to act as a group). Thus, individuals belonging to individualistic culture may choose high parallelism, rather than real-time interaction by technologies providing high social presence (e.g. social presence). On the other hand, people belonging to collectivist culture, may prefer the team to finish the task together and will choose synchronous technologies. Thus, it is proposed that:

P8: *The fit between task type and technology characteristics will be determined by the team dimension.*

Outcomes

We group the outcomes of virtual team work studied by researchers in roughly two main categories: Performance and Satisfaction. Performance includes sub-categories of decision or solution quality and decision or solution time. Satisfaction includes two categories also, viz. satisfaction with the decision/solution and satisfaction with the virtual team experience. Most of the extant research on outcomes can be categorized as a part of the above two categories.

As can be inferred from the above propositions, it is difficult to predict which combination of structural factors would lead to the kind of social interaction that would lead to optimum performance and satisfaction for virtual teams. A virtual team, during deployment will be given a goal to achieve. Cross-functionalism, spatial and cultural dispersion, unfamiliarity with team members and virtual environment are the defining features of computer-mediated virtual teams. Because of the above features, team members may lack shared patterns of behavior, routines for dividing tasks, managing conflict, formulating rules and regulations, coordinating work and so on.

In such a situation, organizational dimension will provide shared orientation for the team members in the form of organizational values and practices focusing on collaboration, respecting and working with people of different cultures, the degree of hierarchical structure, the level or training provided and so on. A shared orientation such as

the above will instill a certain swift trust among group members which will lead to initiation of dialogues from some members and responses from other members. During the first session of electronic initiations and responses among virtual team members, they will draft a mission statement of their own based on the goal provided to them. Such a mission will define the project effectiveness measures; divide the project into sub-tasks based on its complexity; lay a foundation for trust, cohesion, relationship building and establish communication interactions and media choice patterns based on the equivocality of the project.

The choice of patterns and behaviors made by virtual team members during the first electronic communication (i.e. while drafting the mission) will initialize a structuration process. The patterns and behaviors chosen by group members will be constrained by the structural characteristics (organizational dimension, technology and task dimension, group dimension and individual dimension) and new structures will be created due to the unfamiliarity of the members with the virtual environment, lack of shared histories among them. The striving of virtual team members to reduce the difference between structurally constrained behaviors and patterns and the newly created behaviors and patterns will lead to establishment of fixed patterns of behavior and communication and will eventually develop into rules (organizational/team/individual dimension). The virtual team social interaction system is then produced and reproduced as its members use the rules they formed. Hence, it is proposed:

P9*: Effectiveness of virtual team outcomes will result when; 1) Organizational dimension provides a positive level of initial socio emotional processes which will lead to initiations and responses from team members, 2) Appropriation of task technology fit by the organizational, team, and individual dimension, leading to social interaction, 3) the social interaction is able to produce the knowledge demanded by the mission.*

Exploratory Meta-Analysis and Results[5]

An exploratory meta-analysis was conducted for the validation of the proposed theory and included a total of 54 studies from top journals and conferences on Information Systems. The results of meta-analysis support 7 of 9 propositions in previous empirical studies on virtual teams. The aim of meta-analysis is to conduct the literature research in an objective and scientifically accepted manner, by extracting the data (variables and relationships) from the studies, and analyzing these data in a way that is imitable and replicable (Hoof et al. 2005). There can be two types of meta-analyses. A meta-analysis can be a quantitative analysis, compiling correlations found between variables in question in an effort to find the strength of a relationship as an aggregate measure of correlations. Alternatively, a meta-analysis can be an exploratory effort to establish the relevant variables and relationships in a given research area, resulting in evidence of support or non-support for propositions and hence further examination (Hoof et al. 2005). This thesis follows the later approach.

A three step methodology was followed for the meta-analysis. Identification of literature, developing a concept-centric matrix based on the EAST framework, and assessment of the literature.

Identification of Literature

This research includes studies and theories from the early eighties when communication using technology became the interest of researchers, thus using previous theories on computer mediated interaction to build up the theory of this paper. Keywords such as virtual teams, virtual groups, virtual communities, distributed groups, computer mediated groups, global virtual teams, and computer mediated communication in databases such as ACM, JSTOR, Science Direct, and Springer Link. After that, a search was also made on databases such as JAIS, Information Systems Journal, Database of Information systems, Organization Science, Academic Management Review and so on. Once the extant reviews on virtual team research were obtained, a search through their reference list was also made to check whether any articles had been overlooked by previous search on the databases.

Next step consists of setting up criteria for including the studies in the meta-analysis. Total three criteria were set up to limit the scope of this study. First of all, the study to be included must be empirical in nature. By empirical, it is meant that the study involve an actual use of virtual teams, in laboratory or field settings. Second, this study defines the geographical dispersion based on the geographical discontinuity defined by Chudoba et.al (2005). For inclusion in this study, the virtual team studied in a research paper should have the following geographical dispersion:

[5] Due to page limitation, we were not able to include the results in the paper.

- Collaborate with people in different sites or geographies
- Collaborate with people you have never met in your life.

The third criterion defines the acceptable technological dispersion among virtual teams, as defined by Chudoba et.al (2005).

- Work with people via Internet-based conferencing applications (audio-conferencing, web-based applications, online groups, virtual worlds, GDSS and so on)
- Participate in real time online discussions, such as chat or instant messaging
- Meet with people via video-conferencing applications.

A total of 54 studies were finalized for validation of the proposed theory.

Structuring the Data

This qualitative meta-analysis was followed the same, replicable procedure of a quantitative meta-analysis, but was more interpretive than aggregative. During the structuring of data and analysis process, new interpretations were developed instead of a statistical data analysis. We developed a matrix having fields such as the source of the study, independent variables, dependent variables, and description of the study, theories used, and results. This matrix was constantly refined as the studies were added. Consistencies of variables of interest were compared across the studies based on this matrix. Results column was filled by noting the outcomes of the relationships tested by the study as well as evidence observed in the description of the experiment which supported or involved the constructs of interests to the EAST framework. The literature review matrix so developed includes a thorough description of the study, experiments and results.

Assessment of Results

The literature review table was studied to observe the pattern of relationships visible among the constructs of interest. It was checked whether, any of the visible patterns answered the questions posed in this study. If they did not, it was determined whether any other factors explained the unexplained or inconsistent patterns in the concept matrix. For example, is there huge difference between the findings of laboratory studies and field studies? Or are the results inconsistent due to the fact that students were used as subjects in most studies? The findings were used to support the propositions of EAST.

Discussion and Conclusion

The basic underlying premise of the EAST is structuration, which posits that effectiveness can be achieved by evolution and re-evolution of socio-emotional states and decision processes, to match the knowledge requirements demanded by mission, under the structures provided by organization, task-technology fit, team and individual members as virtual teams gradually move toward achieving their mission. The major contribution of this research comes from first identifying factors which might explain inconsistencies in virtual team research, second, developing the EAST framework to organize and gel these identified constructs with existing virtual team research issues, and third, to use EAST to explain how virtual teams' path to success. EAST proposes a set of two overreaching concepts (i.e. previously unconsidered by any research study) by which to design and evaluate research: *influence of mission on social interaction* and *influence of task-technology fit on social interaction*.

Implications for Research: This paper used a theoretical model to organize the past research to better understand how virtual teams attain effectiveness. AST was extended by proposing a new kind of structure called control structure defined by Mission in our framework. This control structure acts to constrain the group behavior by guiding the group to adopt technology support and information processing structures depending upon the equivocality and complexity of the goal. Our research integrates two different theories, i.e. the task-technology fit theory and appropriation theory and thereby suggests new implications for these two theories. The concept of task defined as having two dimensions, i.e. uncertainty and equivocality as suggested by Daft and Lengel and adopted by most studies on virtual teams may have to be redefined as suggested by this research, i.e. the virtual team members will break down the project into several sub-tasks and use different technologies for each task, as per the media demanded by each sub-task.

This paper also highlights one of the major aspects overlooked by researchers of virtual teams till now. Since technology replaces human actors as means of communication in virtual teams, it is reasonable to assume that characteristics and capabilities of technologies will also replace human actors in influencing and forming group processes such as trust, conflict, communication, co-ordination and so on. Recognizing the fact, we developed a framework that defines an expected mix of socio-emotional processes and decision processes resulting from the use of technology capabilities and specific task types.

More research is needed to refine the framework presented in this study and empirically test it. Another important issue for future research is coming up with processing strategies for validating the task-technology framework influencing the socio-emotional and decision processes. Nonetheless, we believe that our theory, Extended Adaptive Structuration Theory (EAST) is an appropriate first step in developing an integrative framework explaining the cycle of specific relationships leading to virtual team effectiveness.

Implications for Practitioners: The existing three reviews of virtual team research originate in different journals and do a good job of presenting existing research in a small scope. However, how will managers and their respective organizations know which constructs to focus on, if they are looking for some specific outputs? How will they know what to change if their virtual teams aren't being as productive or effective and efficient as they had hoped? Our study takes two important steps forward in this direction. First of all, we develop a new theory which identifies and organizes the most important constructs in a single framework and delineates their relationships. Our study will show managers the minimum number of constructs that are absolutely necessary for successful deployment of virtual teams. Next, EAST explains effectiveness based on a particular rhythm (order of events) in which virtual teams must move forward towards their goal. The above claims can be explained as follows:

EAST claims that, the organizational dimension will set the initial levels of socio-emotional processes and decision-processes in virtual teams. Thus, if an organization wants a virtual team to quickly reach a solution, the construct the managers should focus on is the organizational dimension. Extensive training of virtual team members making them aware of the issues involved in virtual environments, making them acquainted with the technology being provided and so on will help them start working towards goals with trust, confidence in communicating by self-initiation and co-ordination by quickly responding to initiations during the first electronic meeting. When goal of virtual teams is very interdependent, decision processes such as co-ordination will be very important and should be focused upon. In such a case, knowledge of which technology characteristics would provide for co-ordination becomes extremely important and might just make the difference between and average virtual team and an effective virtual team. If the goal of virtual teams is something innovative, dynamic and unpredictable, organizations or managers might want to focus on how thoroughly the virtual team members analyze the mission and develop strategies to carry out the mission. And, if regardless of time, only the effectiveness of virtual teams is required, managers can just concentrate on the socio-emotional processes, since constructs like trust and cohesion are the antecedents of satisfaction and longevity in virtual teams

In conclusion, noticing the inexistence of a cogent theory of virtual team success, this paper develops a new theory explaining the patterns leading to virtual team effectiveness. We claim that the theory developed in this research is the next stage of evolution among theories explaining social interaction (human activity) under the influence of structures (resources and rules), after the structuration theory (Giddens, 1984) and adaptive structuration theory (DeSanctis & Poole, 1994a). It provides the practitioners with clear idea of the absolute key drivers and patterns of virtual team effectiveness and thus advices them concerning the effective design and deployment of virtual teams. It also complies and synthesizes research from multiple disciplines such as computer science, computer information systems, and organization science, and thus provides a comprehensive understanding of virtual teams for researchers.

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